HELIX
Environmental Planning

Carlsbad Raceway Riparian Restoration Project

Year 4 Monitoring Report

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CARLSBAD RACEWAY RIPARIAN RESTORATION
YEAR 4 MONITORING REPORT

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1.0 INTRODUCTION

This report presents the results of the fourth annual technical monitoring of the on-site riparian restoration for the Carlsbad Raceway project. This report was prepared in compliance with monitoring program requirements described in the project's Final Riparian Mitigation Plan (hereafter referred to as Mitigation Plan; HELIX Environmental Planning, Inc. [HELIX] 2004). Mitigation is a condition of the U.S. Army Corps of Engineers (Corps) 404 Permit No. 982020500-RJL and California Department of Fish and Game (CDFG) Streambed Alteration Agreement No. R5-2002-0088.

1.1 PROJECT LOCATION

The project site is located just northwest of Business Park Drive and Palomar Airport Road in Carlsbad, northwestern San Diego County (Figures 1 and 2). Elevation on site ranges from approximately 310 to 495 feet above mean sea level. Surrounding land uses include industrial development and vacant or undeveloped land.

1.2 MITIGATION REQUIREMENTS

In addition to on-site preservation of riparian habitats, approximately 1.88 acres of riparian habitats are required to be created to mitigate for impacts to wetland habitats under Corps and CDFG jurisdiction (Figure 3). The loss of southern willow scrub, freshwater marsh, and mule fat scrub would be mitigated by creating southern willow scrub, freshwater marsh, and mule fat scrub on site where disturbed habitat occurred. These created habitats would connect existing wetland habitats in the main drainage on site. The main drainage on site is an unnamed tributary to Agua Hedionda Creek. The acreage of southern willow scrub, freshwater marsh, and mule fat scrub impacted and the corresponding mitigation acreage are presented in Table 1. An additional approximately 0.99 acre of southern willow scrub habitat and 0.06 acre of freshwater marsh habitat were created beyond the required mitigation, although these areas are not required to meet 5-year success criteria for project mitigation sign off.

Table 1
IMPACTS/MITIGATION

Habitat Type	Impacted by Project (acre)*	Mitigation Ratio	Required Mitigation (acre[s])	Actual On-site Mitigation (acre[s])
Southern willow scrub	0.44	3:1	1.32	2.31
Freshwater marsh	0.14	2:1	0.28	0.34
Mule fat scrub	0.14	2:1	0.28	0.28
Streambed	0.17	1:1	0.17	1.10
TOTAL	**0.89**	**--**	**2.05**	**4.03**

*Reflects greatest amount impacted (i.e., CDFG jurisdiction)

Additionally, the loss of 0.17 acre of non-wetland Waters of the U.S. (streambed) was mitigated by restoring a streambed connection with the main drainage where water was diverted in a previously upland area along the edge of the drag strip. Although only 0.17 acre of streambed was required to be created, the project is creating 1.1 acres of streambed.

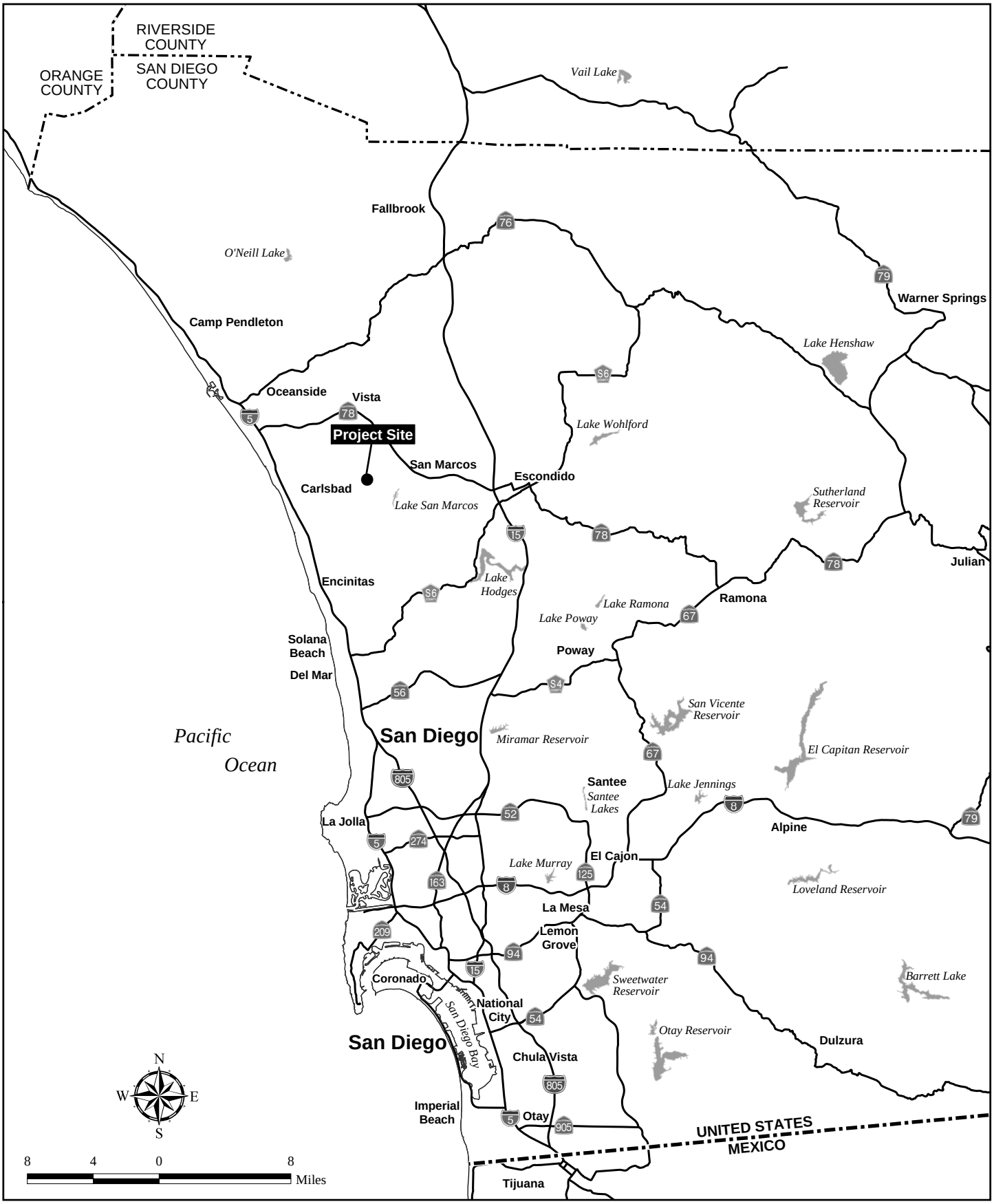
1.3 INSTALLATION

Site preparation of the wetland restoration site began in July 2005 (Table 2). The site was graded and a supplemental irrigation system was installed. Container stock and seed mix were installed by HELIX Environmental Construction Group, Inc. (HECG) in accordance with the riparian plant palette in the Mitigation Plan in spring 2006. Habitat installation was completed on April 14, 2006.

In Year 4, supplemental installation will include 20 mule fat (*Baccharis salicifolia*) cuttings, 20 western ragweed (*Ambrosia psilostachya*), 25 coyote brush (*Baccharis pilularis*), 15 narrow-leaved willow (*Salix exigua*), 3 pounds of goldenbush (*Isocoma menziesii*), 3 pounds of western ragweed, and 3 pounds of mugwort (*Artemisia douglasiana*). This installation is scheduled for the end of December 2010 to early January 2011.

Table 2
RIPARIAN RESTORATION INSTALLATION SUMMARY

DATE	ACTIVITY
July 2005	Site preparation, including site grading and installation of supplemental irrigation.
March 2006	Installation of container stock and seed mixture in accordance with the project's Mitigation Plan.
April 2006	Habitat installation complete. Start of the 5-year maintenance and monitoring period.
August 2008	Installation of 3,435 one-gallon container plants.
April 2009	A total of 23 pounds of seed was applied to freshwater marsh, mule fat scrub, and southern willow scrub habitats.
May 2009	Installation of 30 one-gallon container plants within the disturbed mule fat scrub habitat north of Lot #20.
August 2009	Installation of 32 one-gallon container plants within the mule fat scrub and southern willow scrub
Scheduled December 2010/early January 2011	Install 20 mule fat (*Baccharis salicifolia*) cuttings, 20 western ragweed (*Ambrosia psilostachya*), 25 coyote brush (*Baccharis pilularis*), 15 narrow-leaved willow (*Salix exigua*), 3 pounds of goldenbush (*Isocoma menziesii*), 3 pounds of western ragweed, and 3 pounds of mugwort (*Artemisia douglasiana*).



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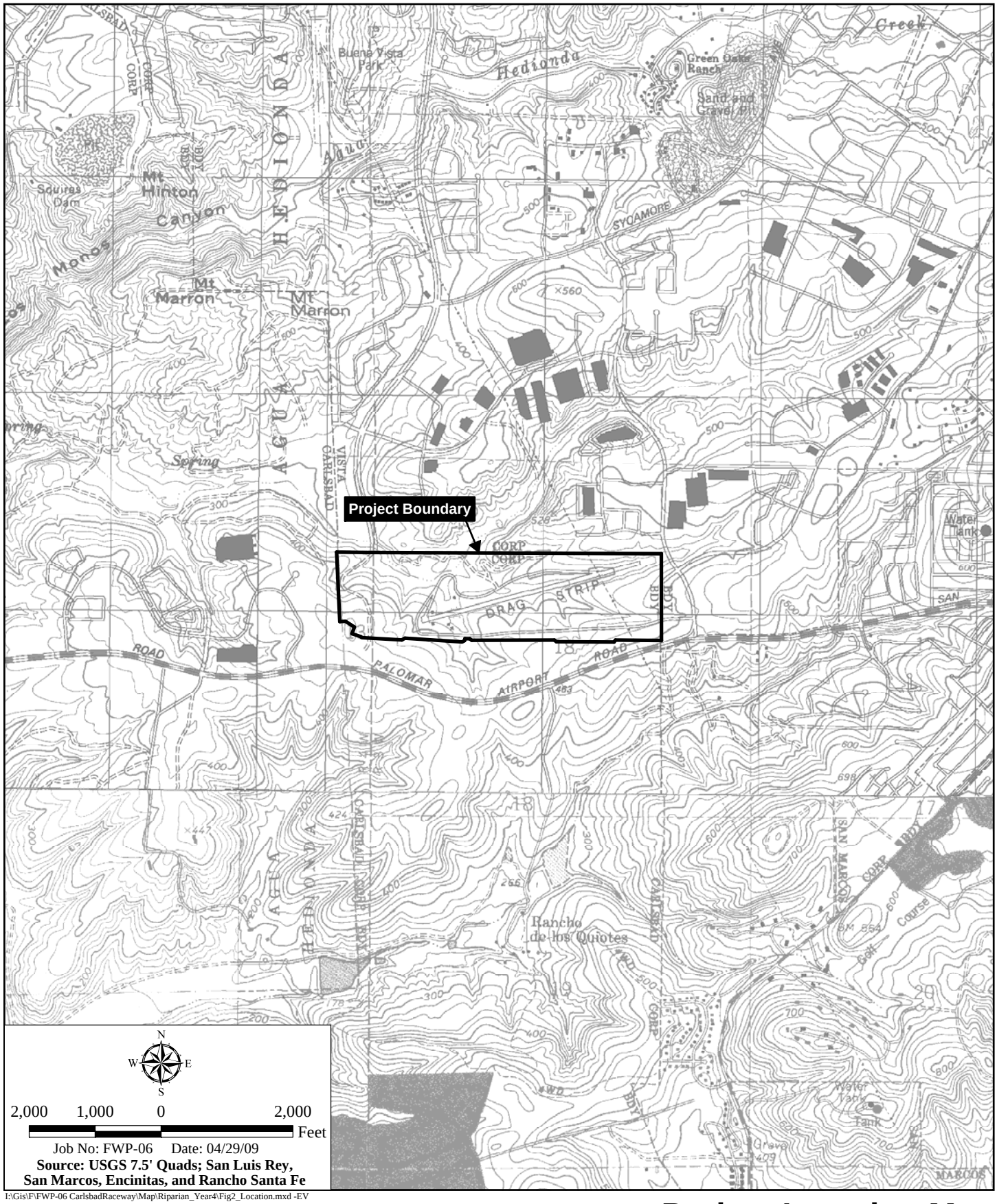
Regional Location Map

YEAR 4 MONITORING REPORT FOR THE
CARLSBAD RACEWAY RIPARIAN RESTORATION

Figure 1

HELIX



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Project Location Map

YEAR 4 MONITORING REPORT FOR THE
CARLSBAD RACEWAY RIPARIAN RESTORATION

HELIX

Figure 2

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HELIX

Riparian Restoration

YEAR 4 MONITORING REPORT FOR THE
CARLSBAD RACEWAY RIPARIAN RESTORATION
Figure 3

2.0 METHODS

The 5-year maintenance and monitoring period for the restoration site was initiated on April 14, 2006 following completion of the habitat installation phase. Maintenance and monitoring are being conducted during this period as directed by the Mitigation Plan.

2.1 MAINTENANCE

HECG is the contractor responsible for maintaining the restoration site during the 5-year maintenance period. Regular maintenance visits are being conducted in which non-native species are identified and controlled. Non-native species control measures are focused on hand-removal and treatment with herbicide. In certain instances, the restoration specialist has authorized the limited use of mechanical line trimmers. In addition to non-native species control, each maintenance visit includes trash removal and erosion control, as necessary.

2.2 MAINTENANCE MONITORING

HELIX biologist Amy Mattson conducted 4 maintenance monitoring visits during the fourth year of monitoring. During each visit, the state of the restored habitat was qualitatively evaluated. Issues relating to the success of the mitigation effort (non-native species, trash, vandalism, low vegetation cover, etc.) were identified and brought to the attention of maintenance personnel, as necessary, via memorandum (Appendix A).

2.3 ANNUAL TECHNICAL MONITORING

HELIX biologists Ms. Mattson and Erica Harris conducted the fourth annual monitoring visit on September 22, 2010. Plants in this report were identified with The Jepson Manual: Higher Plants of California (Hickman, ed. 1993), and plant naming conventions follow the Checklist of the Vascular Plants of San Diego County (Simpson and Rebman 2006). Vegetative monitoring techniques are based on the project's Mitigation Plan (HELIX 2004). Animal nomenclature used in this report is taken from Opler and Wright (1998) for butterflies, Collins and Taggart (2002) for amphibians and reptiles, American Ornithologists' Union (2010) for birds, and Baker et al. (2003) for mammals. Sensitive species status follows the CDFG California Natural Diversity Database (2009 and 2010) and USFWS (2010).

Data collected during the annual monitoring events are used to determine if the project has met success criteria for the given year. For Years 1 and 2, monitoring consisted of visual assessments along with photographic documentation of the site as described in the project's Mitigation Plan. Photos were taken at 15 photo locations that were established during the first annual monitoring visit in 2007 (Figure 3; Appendix B).

Years 3 through 5 will implement more extensive quantitative annual monitoring procedures. Five permanent transects were established during Year 3 monitoring, including three 50-meter (m) transects (Transects 1 through 3) in the southern willow scrub habitat, one 50-m transect (Transect 4) in streambed habitat, and one 25 m transect in the mule fat scrub habitat (Transect 5). The mule fat scrub habitat transect is 25-m due to the small size of the mule fat

scrub restoration areas. No transects were established in the freshwater marsh habitat due to the small size of the freshwater marsh restoration areas. The freshwater marsh habitat will continue to be evaluated qualitatively.

One (25-m) reference transect (Transect 6) was established on site in the existing riparian habitat north of Transect 1.

The 2 ends of each line transect were permanently marked with a rebar stake covered with white PVC pipe. Every 50 centimeters (cm) along each transect (beginning at the 50-cm mark), a point was projected into the vegetation, and species intercepted by the point were recorded. Vegetation intercepts were categorized into herb (less than 60 cm), shrub (60 to 200 cm), and tree (greater than 200 cm) layers. Total cover is the percentage of points along the transect intercepted by vegetation. A single point may be intercepted by plants in multiple layers but would be counted only as a single point for total cover. Percent herb, shrub, and tree cover categories were calculated for both native and non-native species.

Photographs of each restoration site line transect were taken near each 0-m marker facing the opposite marker (Appendix B). A list of all plant species within each transect plot was compiled and is presented as Appendix C, and a list of animal species detected within the site is presented as Appendix D. Transect data are included in Appendix E.

3.0 SUCCESS CRITERIA

Success criteria have been established in the project's Mitigation Plan to provide specific standards to evaluate the progress and success of the mitigation effort (Table 3). Each year the project must attain the specific criteria standards for native species diversity, similarity, native species cover, and non-native species cover.

Table 3
SUCCESS CRITERIA MILESTONES

CRITERIA	YEAR				
	1	2	3	4	5
Native species richness*	N/A	N/A	60	70	80
Similarity*	N/A	N/A	50	65	90
Native species cover*	N/A	N/A	55	75	90
Non-native species cover†	<10				

*Values are percentages compared to reference transect.
†Non-native species cover shall not exceed 10 percent at any time during the maintenance and monitoring period.

3.1 NATIVE SPECIES RICHNESS

Native species richness is the number of native species in a given area: the higher the number of species, the higher the richness. Annual native species richness criteria have been established to determine project success. In Year 4, species richness within the restoration site should be at least 70 percent of the number of species observed in the reference area. At the end of the 5-year monitoring period, species richness from the restoration site should meet the Year 5 species richness success criterion of 80 percent when compared to the reference transect (Table 3).

3.2 SIMILARITY

Similarity is the percent total vegetative cover within the restoration site compared to the reference site. In Year 4, similarity within the restoration site should be at least 65 percent of the total vegetative cover observed in the reference area. At the end of the 5-year monitoring period, similarity of the restoration site should meet the Year 5 similarity success criterion of 90 percent when compared to the reference transect (Table 3).

3.3 NATIVE SPECIES COVER

Native species cover should increase over time and ultimately approach (or exceed) that of existing adjacent habitat. Cover within a restoration site is often slow at first as plants become established, but with sufficient rainfall and adequate maintenance, native cover should approach 90 percent of the reference transect's native cover within 5 years (Table 3). In Year 4, species cover within the restoration site should be at least 75 percent of the native species cover observed in the reference transect.

3.4 NON-NATIVE SPECIES COVER

Non-native species are typically a problem with habitat restoration, particularly at the onset of the project. As the mitigation takes hold, non-native species problems should decrease. Non-native species cover shall not exceed 10 percent at any time during the maintenance and monitoring period (Table 3).

4.0 RESULTS

4.1 NATIVE SPECIES RICHNESS

The native species richness along the reference area transect was 10 species. Therefore, the Year 4 success criterion for species richness is at least 7 native species (i.e., 70 percent of the reference area's 10 species).

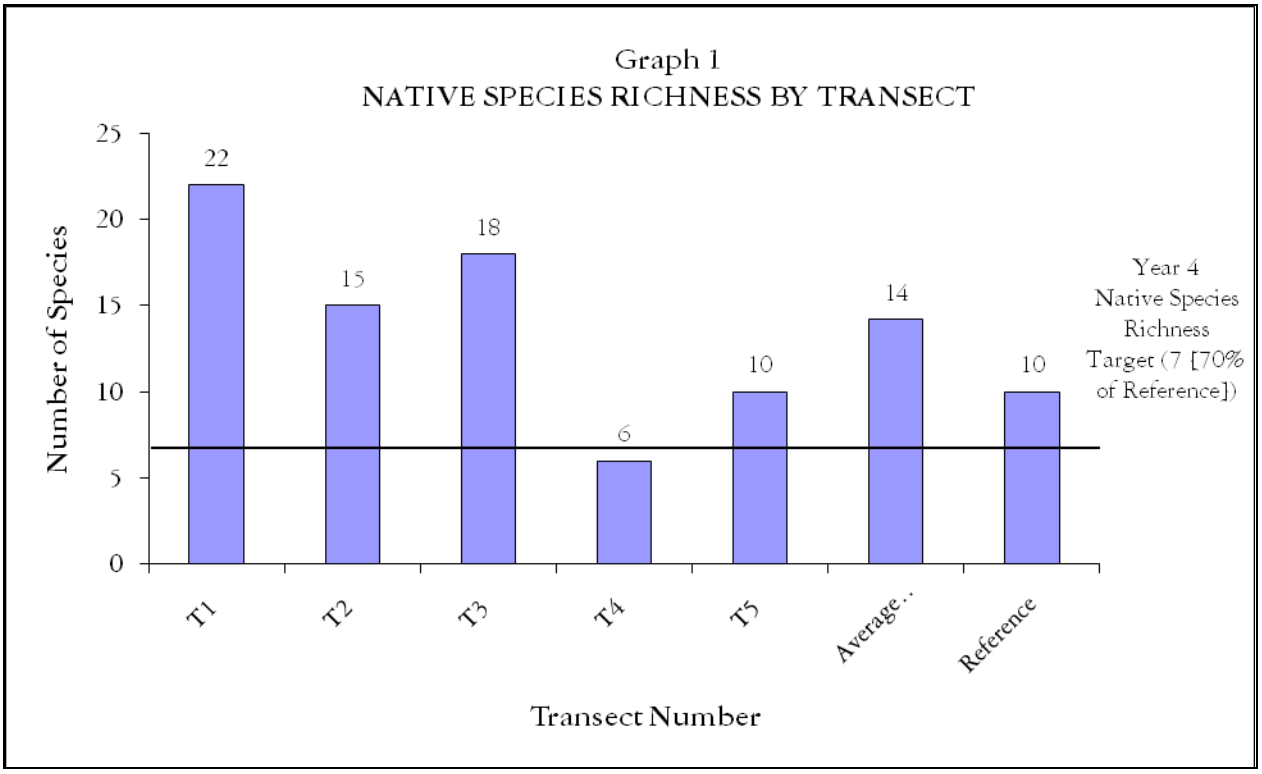
A total of 33 native species and 12 non-native species were observed within the restoration site (Appendix C). Average species richness for the 5 restoration area transects was 11 (Table 4; Graph 1), which exceeds the Year 4 success criterion of at least 7 native species. Species richness was highest along Transects 1 and 3 (southern willow scrub areas), with 22 species

recorded in Transect 1 and 18 species in Transect 3. Species richness was lowest along Transect 4, with 6 species recorded in the belt transects. Transect 4 crosses an area designed to be streambed habitat, but that has developed into freshwater marsh habitat. The freshwater marsh area is dominated by broad-leaf cattail (*Typha latifolia*) and lower diversity in this vegetation community is not unexpected.

Table 4
YEAR 4 RESULTS

	REFERENCE AREA RESULTS	YEAR 4 CRITERIA[1]	RESTORATION AREA RESULTS
Species richness	10	7 (70% of 10)	14
Similarity	N/A	64 (65% of 98)	86
Native species cover	98	74 (75% of 98)	83
Non-native species cover	2	10	12

[1]Values are relative to reference transect.



4.2 SIMILARITY

The average total overall vegetative cover within the riparian restoration site was 83 percent, with the remaining 17 percent being bare ground or leaf litter (Table 4). The average total cover in the reference site was 98 percent. Therefore, similarity (percent total vegetative cover) within the restoration site compared to the reference site (98 percent total vegetative cover) was 86 percent, which exceeds the Year 4 criterion of 64 percent (65 percent of the total cover in the reference area).

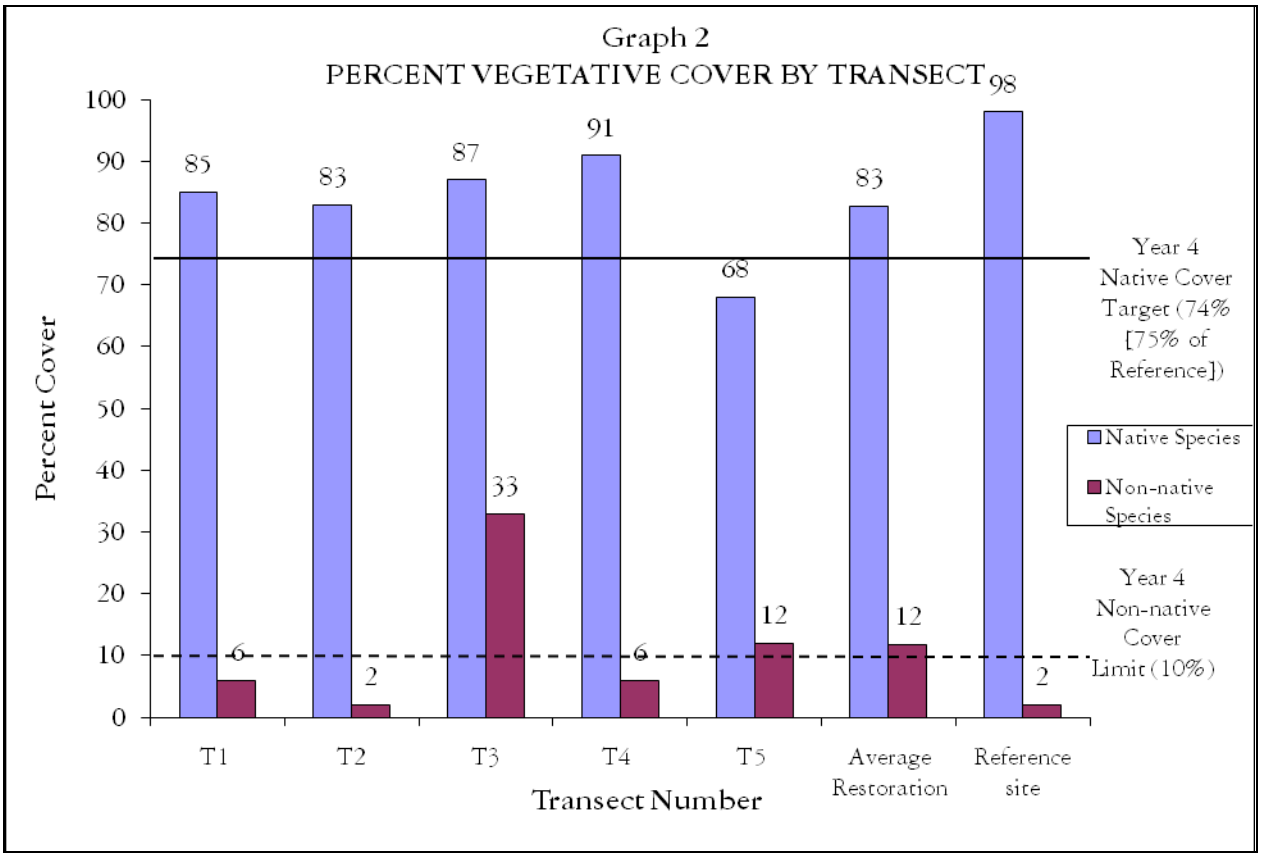
4.3 NATIVE SPECIES COVER

Average native cover within the restoration site was 83 percent (Table 4), which included 32 percent native cover in the herb layer, 69 percent native cover in the shrub layer, and 8 percent native cover in the tree layer. The most abundant native species in the herb layer were salt marsh fleabane (*Pluchea odorata*), western ragweed, (*Juncus acutus* ssp. *leopoldii*), great marsh evening-primrose (*Oenothera elata* ssp. *hookeri*), and saltgrass (*Distichlis spicata*). Broad-leaf cattail (*Typha* sp.), prairie bulrush (*Bolboschoenus maritimus* ssp. *paludosus*), goldenbush, and narrow-leaved willow were the dominant species in the shrub layer. Arroyo willow, mule fat, and narrow-leaved willow comprised the majority of the native tree layer.

Native cover was measured to be 85 percent in the southern willow scrub (Transects 1-3), 91 percent in the streambed/freshwater marsh (Transect 4), and 68 percent in mule fat scrub (Transect 5; Graph 2).

Native cover along the reference area transect was 98 percent, which included 16 percent in the herb layer, 22 percent native cover in the shrub layer, and 84 percent native cover in the tree layer. Though largely consisting of leaf litter, the herb layer was dominated by watercress (*Rorippa nasturtium-aquaticum*), the shrub layer consisted primarily of a few individuals of mule fat, and the tree layer was dominated by arroyo willow.

With 83 percent native cover, the restoration site exceeded the Year 4 success criterion for native species cover of 74 percent. Overall, native cover increased from 75 percent in Year 3 to 83 percent in Year 4. This increase is attributed to the herb and shrub layers, which both increased (the herb layer increased from 25 percent in Year 3 to 32 percent in Year 4; the shrub layer increased from 57 percent in Year 3 to 69 percent in Year 4).



4.4 NON-NATIVE SPECIES COVER

Average annual non-native species cover within the restoration site was approximately 12 percent (Table 4). The restoration site fell just short of the Year 4 success criterion for non-native species cover (less than 10 percent). The most abundant non-native species was annual beard grass (*Polypogon monspeliensis*). There was 2 percent non-native species cover within the reference area transect, consisting of wild celery (*Apium graveolens*).

Non-native cover averaged 12 percent for the mule fat scrub transects, 14 percent for the southern willow scrub transects, and 6 percent for the streambed transect. Non-native cover was measured to be very low (between 2 and 6 percent) in Transects 1, 2, and 4 (southern willow scrub and freshwater marsh areas; Graph 2). Non-native cover was slightly high in the 25-m mule fat scrub transect (Transect 5), which was measured to be 12 percent. Non-native cover was high in Transect 3 (33 percent), consisting exclusively of annual beardgrass. This non-native cover was subsequently reduced to less than 10 percent during maintenance visits.

5.0 DISCUSSION

Overall, the majority of the wetland restoration site was progressing well and met the Year 4 success criteria for native species richness, cover, and similarity. Native species richness and native cover were high at the end of Year 4. The total number of native species increased from 31 species in Year 3 to 33 species in Year 4. Native species cover within the restoration site has continually increased - from 35 percent in Year 1, to 45 percent in Year 2, to 75 percent in Year 3, and to 83 percent in Year 4. Non-native species cover has remained low throughout Year 4, and, at the time of the annual assessment, was measured to be slightly above the Year 4 success criterion, which was due almost entirely to annual beardgrass along 1 transect. Subsequent maintenance reduced non-native cover in the areas to below 10 percent.

Although native species cover increased, native tree layer cover remains low (averaging 8 percent) and many of the tree species observed within the site, which include mostly willows, remain short and thin. Native tree cover was estimated to be approximately 5 percent in both Years 1 and 2, and 17 percent in Year 3, and 8 percent in Year 4. Also, several areas of mule fat scrub and southern willow scrub are struggling to develop into mature habitat. The habitat around Transect 5 has only 68 percent native cover (20 percent in the herb layer, 64 percent in the shrub layer, and no measured cover in the tree layer). Although native cover along Transect 2 was measured to be 83 percent, the narrow-leaved willow in this portion of the restoration site is stunted and struggling.

It was first noticed in Year 3 that arroyo willow trees on site were being affected by a native clearwing moth species. Samples of this moth from several of HELIX's restoration sites have been submitted to the County of San Diego Agriculture Department. The species has been identified as the western poplar clearwing (clearwing moth; *Paranthrene robiniae*). Adult clearwing moths lay their eggs at the base of willow trees. Upon hatching, the larvae bore into the bark of the trees and feed on the woody parts. The clearwing moth larvae cause tree branches to die slowly and eventually the entire tree can die. Several studies indicate that the adult moths are attracted to stressed individuals of willow, such as the young trees found on this site. No new evidence of clear-winged moth was observed in Year 4, however, 2010 has been an above-average rainfall year, and plants are expected to be less stressed. HELIX will continue to monitor for additional evidence of clear-winged moth issues.

At the time of the annual assessment, all but 2 of the restoration areas met the success criterion of less than 10 percent non-native species cover. Maintenance after the annual assessment reduced non-native cover to below 10 percent in all areas. Regular, frequent, and complete non-native species removal should continue in order to keep the non-native species percent cover low and meet the Year 5 success criterion (less than 10 percent). Non-native species removal must be performed prior to flower development in order to minimize reseeding of the restoration site. All non-native species material must be removed from the restoration site and disposed of in a proper and legal manner. Maintenance activities should continue at least every other month through Year 5 of the 5-year maintenance and monitoring period (as described in the Mitigation Plan), or more often as needed. Monitoring will be conducted on a quarterly basis, or more often as needed.

Irrigation was turned off in July 2009 and should remain off for the duration of the project.

Overall, the restoration site is on track to meet its final success criteria in 2011. As described in Section 1.2, the restoration occurring on the Raceway site is twice as large as the required acreage. Because it is a 4-acre restoration project, it is fully expected that there will be small portions of the site that will have lower cover and lower richness because of variations in soil, hydrology, and other biotic and abiotic factors, which is the case on Raceway. However, the majority of the Raceway restoration is exceeding the success criteria and is expected to be accepted by the permitting agencies in 2011. In preparation for signoff, HELIX attended a compliance walk with the Corps (Lanika Cervantes and Michelle Mattson) on October 29, 2010, and no concerns with the restoration were noted. HELIX will work with the maintenance contractor to implement minor recommendations in Year 5 in order to continue to improve the restoration site.

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Appendix A

MAINTENANCE MONITORING MEMOS

Helix Environmental Construction Group Punch List

Project	Carlsbad Raceway wetland
Job Number	FWP-06
Date	5/7/2010

Item #	Recommendation (HEP)	Completed (Y/N)	Date	Comments (HECG)
1	Weed the entire site, with attention to sweet-clover, rabbitfoot grass, brass-buttons, tamarisk, mustard, fennel, non-native grasses, and filaree noted on the aerial.			
2	Install 20 mule fat cuttings along channel (18-24" deep)(see aerial).			
3	In fall, plant 20 western ragweed in shallow-soils area over asphalt/concrete, where mule fat have uprooted (see aerial).			
4	In fall, replant 7 coyote brush in bare, disturbed SWS (see aerial).			
5	In fall, install 15 coyote brush on the slopes of the large wetland area (see aerial).			
6	In fall, plant 5 broom baccharis in northern MFS (see aerial).			
7	Plant bare area (shown on aerial) with 15 narrow-leaved willow.			
8	Install 3 coyote brush in westermost SWS (see aerial).			
9	Remove pile of plant debris from western SWS (see aerial).			
10	Repair eroded area in northwest end of restoration area (see aerial).			
11	Remove all trash (including tires) from site (see aerial).			

Helix Environmental Construction Group Punch List

Project	Carlsbad Raceway - Wetland
Job Number	FWP-06 Wetland
Date	10/25/2010

Item #	Recommendation (HEP)	Completed (Y/N)	Date	Comments (HECG)
1	Weed the entire site, with particular attention to rabbitfoot grass noted on the aerial.			
2	Order 3 pounds each of *Isocoma menziesii*, *Ambrosia psilostachya*, and *Artemisia douglasiana* seed. Install 1/3 of this (1 pound of each species) ASAP in the eastern mule fat scrub.			
3	The remaining seed should be installed later in the rainy season (2 batches). We are hedging our bets that it will germinate but not be washed out.			

Helix Environmental Construction Group Punch List

Project	Carlsbad Raceway - Wetland
Job Number	FWP-06 Wetland
Date	10/25/2010

Item #	Recommendation (HEP)	Completed (Y/N)	Date	Comments (HECG)
1	Weed the entire site, with particular attention to rabbitfoot grass noted on the aerial.	Y	10/26/2010	
2	Order 3 pounds each of *Isocoma menziesii*, *Ambrosia psilostachya*, and *Artemisia douglasiana* seed. Install 1/3 of this (1 pound of each species) ASAP in the eastern mule fat scrub.			
3	The remaining seed should be installed later in the rainy season (2 batches). We are hedging our bets that it will germinate but not be washed out.			

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Appendix B

REPRESENTATIVE PHOTOGRAPHS

Photo Station 1. Looking southwest across mule fat scrub habitat.

Photo Station 2. Looking west across streambed habitat.

Photo Station 3. Looking northwest across streambed habitat.

Photo Station 4. Looking southwest across southern willow scrub habitat.

Photo Station 5. Looking northwest across southern willow scrub habitat.

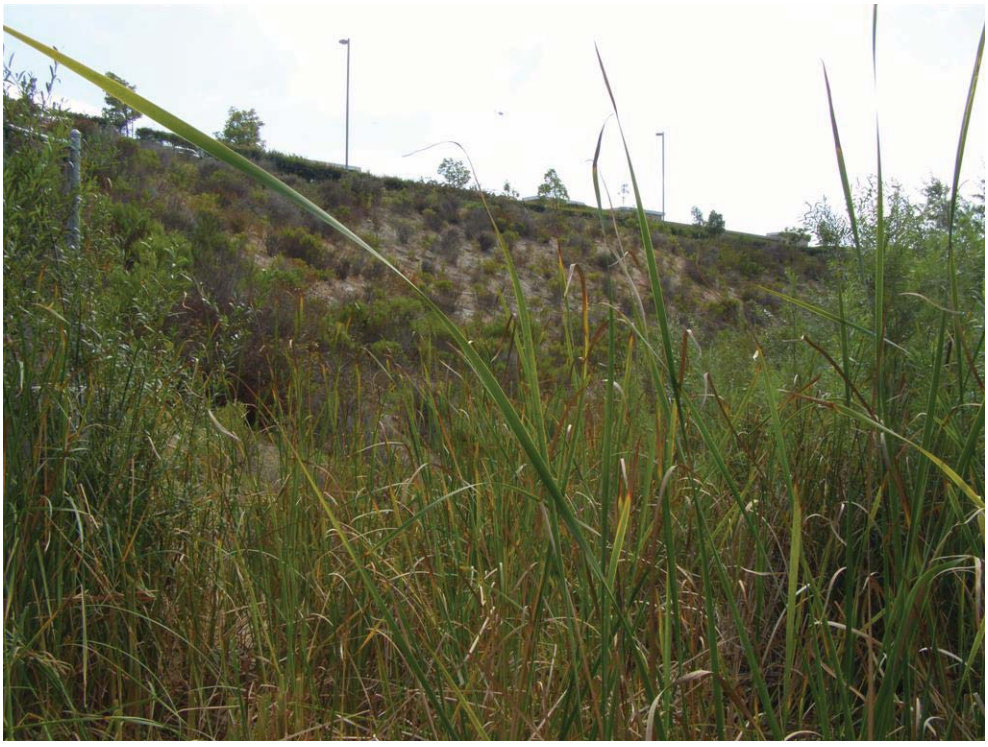


Photo Station 6. Looking southwest across southern willow scrub habitat.

Photo Station 7. Looking east across southern willow scrub habitat.

Photo Station 8. Looking east across freshwater marsh habitat.

Photo Station 9. Looking southeast across freshwater marsh habitat.

Photo Station 10. Looking southeast across southern willow scrub habitat.

Photo Station 11. Looking southwest across southern willow scrub habitat.

Photo Station 12. Looking northwest across freshwater marsh habitat.

Photo Station 13. Looking north across mule fat scrub habitat.

Photo Station 14. Looking northeast across southern willow scrub habitat.

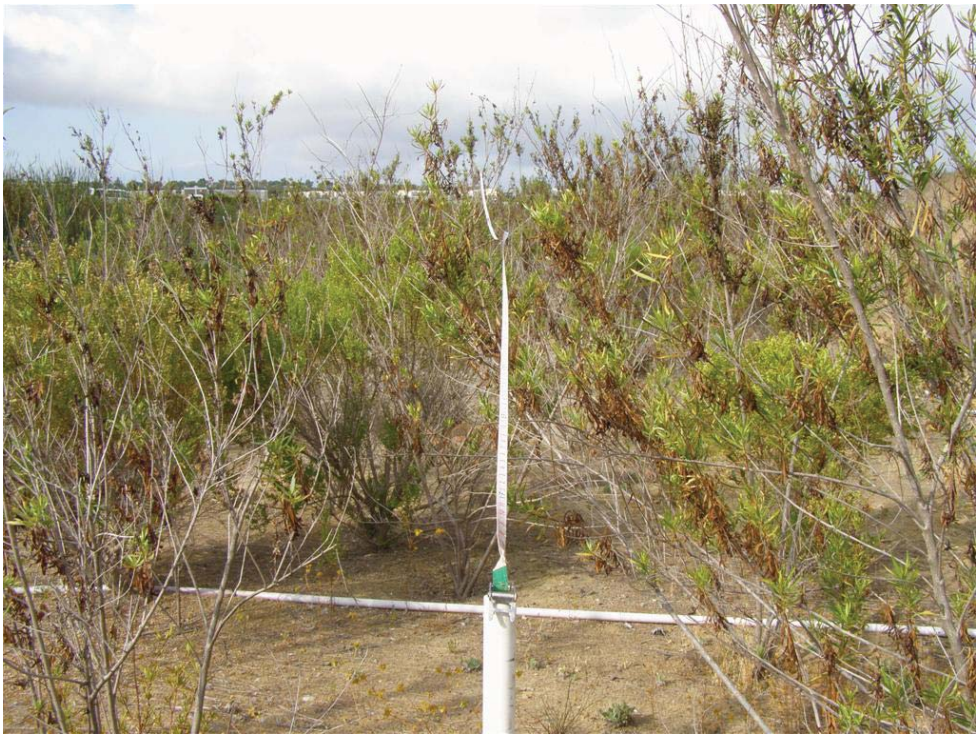
Photo Station 15. Looking east across southern willow scrub habitat.

Transcect 1.

Transcect 2.

Transect 3.

Transect 4.



Transect 5.

Southern willow scrub reference transect .

Appendix C

PLANT SPECIES OBSERVED

Appendix C
PLANT SPECIES OBSERVED
YEAR 4 CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT

FAMILY	SCIENTIFIC NAME	COMMON NAME
DICOTYLEDONES		
Adoxaceae	*Sambucus mexicana*	blue elderberry
Amaranthaceae	*Sarcocornia pacifica*	Pacific pickleweed
Anacardiaceae	*Malosma laurina*	laurel sumac
	Rhus integrifolia	lemonadeberry
Apiaceae	*Apium graveolens**	celery
Asteraceae	*Ambrosia psilostachya*	western ragweed
	Artemisia californica	California sagebrush
	Artemisia douglasiana	Douglas mugwort
	Baccharis pilularis	coyote brush
	Baccharis salicifolia	mule fat
	Conyza canadensis	horseweed
	*Cotula coronopifolia**	brass buttons
	Deinandra fasciculata	fascicled tarplant
	*Dittrichia graveolens**	stinkwort
	Encelia californica	California encelia
	Gnaphalium californicum	California everlasting
	Heterotheca grandiflora	telegraph weed
	Isocoma menziesii var. *menziesii*	San Diego goldenbush
	Iva hayesiana	San Diego marsh-elder
	*Picris echioides**	bristly ox-tongue
	Pluchea odorata	salt marsh fleabane
	*Sonchus asper**	prickly sow thistle
	Symphyotrichum [*Aster*] *subulatum* var. *ligulatum*	slim aster
Boraginaceae		
Caryophyllaceae	*Spergularia* sp.*	sand-spurrey
Fabaceae	*Lotus scoparius*	deerweed
Fagaceae	*Quercus agrifolia*	coast live oak
Lamiaceae	*Salvia mellifera*	black sage
Myrsinaceae	*Anagallis arvensis**	red pimpernel
Onagraceae	*Epilobium ciliatum* ssp. *ciliatum*	willow herb
	Oenothera elata ssp. *hookeri*	great marsh evening-primrose
Polygonaceae	*Eriogonum fasciculatum*	California buckwheat
Salicaceae	*Populus fremontii* ssp. *fremontii*	western cottonwood
	Salix exigua	narrow-leaf willow
	Salix gooddingii	Goodding's black willow
	Salix lasiolepis	arroyo willow
Tamaricaceae	*Tamarix* sp.*	tamarisk

Appendix C (cont.)
PLANT SPECIES OBSERVED
YEAR 4 CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT

FAMILY	**SCIENTIFIC NAME**	**COMMON NAME**
MONOCOTYLEDONES		
Cyperaceae	*Bolboschoenus maritimus* ssp. *paludosus*	prairie bulrush
	Schoenoplectus acutus var. *occidentalis*	viscid bulrush
Juncaceae	*Juncus acutus* ssp. *leopoldii*	southwestern spiny rush
Poaceae	*Brachypodium distachyon**	purple falsebrome
	*Bromus madritensis**	foxtail chess
	*Cortaderia selloana**	pampas grass
	Distichlis spicata	saltgrass
	Nassella lepida	foothill needlegrass
	Nassella sp.	needlegrass
	*Polypogon monspeliensis**	annual beard grass
Typhaceae	*Typha* sp.	cattail

*Non-native species

Appendix D

ANIMAL SPECIES OBSERVED

Appendix D
ANIMAL SPECIES OBSERVED
YEAR 4 CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT

ORDER/FAMILY	SCIENTIFIC NAME	COMMON NAME
INVERTEBRATES		
Order Orthoptera	--	unidentified grasshopper
Order Diptera		
Bombyliidae	--	beefly
Culicidae	--	unidentified mosquito
Order Homoptera		
Aphrophoridae/ Cercopidae	--	spittlebug
Order Hymenoptera		
Apiidae	*Apis mellifera mellifera*	honey bee
Formicidae	*Linepithema humile*	Argentine ant
Order Lepidoptera		
Riodinidae	*Apodemia mormo virguti*	Behr's metalmark
	Limenitis lorquini	Lorquin's admiral
Pieridae	*Pontia protodice*	checkered (common) white
	--	unidentified white butterfly
Papilionidae	*Papilio eurymedon*	pale swallowtail
Order Odonata		
Lestidae	--	damselfly
Libellulidae	--	dragonfly
VERTEBRATES		
Birds		
Order Columbiformes		
Columbidae	*Zenaida macroura*	mourning dove
Order Accipitriformes		
Cathartidae	*Cathartes aura*	turkey vulture
Order Falconiformes		
Accipitridae	*Accipiter cooperii* †	Cooper's hawk
	Buteo jamaicensis	red-tailed hawk
	Falco sparverius	American kestrel
Order Passeriformes		
Corvidae	*Corvus brachyrhynchos*	American crow
	Corvus corax	common raven
	Aphelocoma californica [*Aphelocoma coerulescens*]	western scrub-jay
Aegithalidae	*Psaltriparus minimus*	bushtit
Troglodytidae	*Troglodytes aedon*	house wren

Appendix D (cont.)
ANIMAL SPECIES OBSERVED
YEAR 4 CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT

ORDER/FAMILY	SCIENTIFIC NAME	COMMON NAME
VERTEBRATES (cont.)		
Birds (cont.)		
Order Passeriformes (cont.)		
Emberizidae	*Melospiza melodia*	song sparrow
	Pipilo crissalis	California towhee
	Pipilo maculatus	spotted towhee
	Zonotrichia leucophrys	white-crowned Sparrow
Icteridae	*Agelaius phoeniceus*	red-winged blackbird
Fringillidae	*Carpodacus mexicanus*	house finch
	Spinus psaltria [*Carduelis psaltria*]	lesser goldfinch
Mimidae	*Toxostoma redivivum*	California thrasher
Parulidae	*Geothlypis trichas*	common yellowthroat
	Icteria virens	yellow-breasted chat †
Order Piciformes		
Tyrannidae	*Sayornis nigricans*	black phoebe
Tyrannidae	*Tyrannus* sp.	kingbird
Order Trochiliformes		
Trochilidae	*Calypte anna*	Anna's hummingbird
Reptiles		
Order Squamata		
Phrynosomatidae	*Uta stansburiana*	side-blotched lizard
Mammals		
Order Carnivora		
Canidae	*Canis latrans*	coyote
	Lynx rufus	bobcat
Procyonidae	*Procyon lotor*	raccoon
Order Lagomorpha		
Leporidae	*Sylvilagus audubonii*	desert cottontail
Order Perissodactyla		
Equidae	*Equus ferus*	horse

† Sensitive species

Appendix E

TRANSECT DATA

Appendix E
TRANSECT DATA – CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT
YEAR 4 MONITORING REPORT

TRANSECT 1 (SWS)				
m	**Species Layer**			**Belt Transect Species**
	Herb	**Shrub**	**Tree**	
0.5	LL			Native (22)
1	BG	*Isocoma menziesii*		*Ambrosia psilostachya*
1.5	*Isocoma menziesii*	*Isocoma menziesii*		*Artemisia californica*
2	*Isocoma menziesii*	*Isocoma menziesii*		*Artemisia douglasiana*
2.5	LL			*Baccharis pilularis*
3	*Isocoma menziesii*	*Isocoma menziesii*		*Baccharis salicifolia*
3.5	LL	*Isocoma menziesii*		*Bolboschoenus maritimus* ssp. *paludosus*
4	LL	*Isocoma menziesii*		*Conyza canadensis*
4.5	*Gnaphalium californicum*	*Isocoma menziesii, Baccharis pilularis*		*Deinandra fasciculata*
5	unidentified aster			*Eriogonum fasciculatum*
5.5	LL	*Isocoma menziesii*		*Gnaphalium californicum*
6	LL	*Isocoma menziesii*		*Heterotheca grandiflora*
6.5	*Isocoma menziesii*	*Isocoma menziesii*		*Isocoma menziesii*
7	*Isocoma menziesii*	*Isocoma menziesii*		*Juncus acutus*
7.5	LL	*Isocoma menziesii*		*Malosma laurina*
8	LL	*Isocoma menziesii*		*Oenothera elata*
8.5	*Ambrosia psilostachya*	*Isocoma menziesii*		*Quercus agrifolia*
9	*Ambrosia psilostachya*	*Isocoma menziesii, Ambrosia psilostachya*		*Rhus integrifolia*
9.5	*Ambrosia psilostachya*	*Isocoma menziesii*		*Salix exigua*
10	*Ambrosia psilostachya*	*Baccharis salicifolia*		*Salix lasiolepis*
10.5	*Ambrosia psilostachya, Isocoma menziesii*			*Salvia mellifera*
11	*Ambrosia psilostachya*			*Schoenoplectus acutus* var. *occidentalis*
11.5	*Ambrosia psilostachya, Isocoma menziesii, Juncus acutus*			*Symphyotrichum* [*Aster*] *subulatum*
12	LL			
12.5	LL	*Isocoma menziesii*		Non-native (4)
13	*Ambrosia psilostachya, Juncus acutus*	*Isocoma menziesii*		*Anagallis arvensis*
13.5	*Ambrosia psilostachya*	*Salix exigua, Isocoma menziesii* - dead		*Bromus madritensis*
14	*Juncus acutus*	*Isocoma menziesii, Ambrosia psilostachya*		*Picris echioides*
14.5	*Ambrosia psilostachya, Juncus acutus*			*Polypogon monspeliensis*
15	*Ambrosia psilostachya*	*Isocoma menziesii*		
15.5	*Ambrosia psilostachya, Isocoma menziesii*	*Isocoma menziesii*		Unidentified (1)
16	*Ambrosia psilostachya*	*Isocoma menziesii*		Unidentified aster
16.5	*Ambrosia psilostachya*	*Isocoma menziesii*		

Herb Layer
Natives: 42%
Non-natives: 6%
Shrub Layer
Natives: 55%
Non-natives: 0%
Tree Layer
Natives: 20%
Non-natives: 0%

Total Native Cover: 85%
Native Richness: 22

Appendix E (cont.)
TRANSECT DATA – CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT
YEAR 4 MONITORING REPORT

TRANSECT 1 (cont.)				
m	**Species Layer**			**Belt Transect Species**
	Herb	**Shrub**	**Tree**	
17	LL	*Isocoma menziesii*		
17.5	*Ambrosia psilostachya*	*Isocoma menziesii*		
18	*Ambrosia psilostachya*	*Isocoma menziesii* - dead		
18.5	*Ambrosia psilostachya*	*Isocoma menziesii, Salix lasiolepis*		
19	LL	*Isocoma menziesii* - dead		
19.5	*Isocoma menziesii*			
20	LL	*Salvia mellifera*		
20.5	*Ambrosia psilostachya*	*Salix exigua, Salvia mellifera*		
21	*Isocoma menziesii*			
21.5	LL			
22	LL			
22.5	*Ambrosia psilostachya*			
23	*Ambrosia psilostachya*		*Baccharis salicifolia* - dead	
23.5	*Ambrosia psilostachya*		*Baccharis salicifolia* - dead	
24	*Ambrosia psilostachya*		*Baccharis salicifolia* - dead	
24.5	*Isocoma menziesii*			
25	*Isocoma menziesii*	*Isocoma menziesii* - dead		
25.5	*Isocoma menziesii*	*Isocoma menziesii* - dead		
26	*Isocoma menziesii*	*Isocoma menziesii* - dead		
26.5	*Ambrosia psilostachya*	*Salix lasiolepis, Isocoma menziesii* - dead		
27	*Artemisia californica*			
27.5	BG			
28	BG			
28.5	*Isocoma menziesii*		*Baccharis salicifolia, Salix lasiolepis*	
29	*Artemisia californica*			
29.5	*Artemisia californica*			
30	LL	*Isocoma menziesii*	*Baccharis salicifolia*	
30.5	LL	*Isocoma menziesii, Salvia mellifera*	*Baccharis salicifolia*	
31	LL	*Salvia mellifera*	*Baccharis salicifolia*	
31.5	LL	*Salvia mellifera*	*Baccharis salicifolia*	
32	LL	*Isocoma menziesii, Salvia mellifera*	*Baccharis salicifolia*	

Appendix E (cont.)
TRANSECT DATA – CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT
YEAR 4 MONITORING REPORT

TRANSECT 1 (cont.)				
m	**Species Layer**			**Belt Transect Species**
	Herb	**Shrub**	**Tree**	
32.5	LL	*Isocoma menziesii*	*Baccharis salicifolia*	
33	LL	*Isocoma menziesii*	*Baccharis salicifolia*	
33.5	LL	*Isocoma menziesii*		
34	LL	*Isocoma menziesii*	*Salix lasiolepis*	
34.5	LL		*Salix lasiolepis*	
35	LL		*Salix lasiolepis*	
35.5	LL	*Salix lasiolepis* - dead		
36	LL	*Isocoma menziesii*		
36.5	LL	*Isocoma menziesii*		
37	LL	*Isocoma menziesii*		
37.5	*Isocoma menziesii*	*Salix lasiolepis* - dead		
38	LL	*Isocoma menziesii*		
38.5	LL	*Isocoma menziesii*		
39	LL	*Isocoma menziesii, Salix lasiolepis* - dead		
39.5	LL	*Isocoma menziesii, Salix lasiolepis* - dead		
40	LL	*Isocoma menziesii*		
40.5	LL			
41	LL	*Salix lasiolepis* - dead		
41.5	BG			
42	LL	*Baccharis pilularis*		
42.5	LL			
43	BG			
43.5	BG	*Isocoma menziesii*		
44	LL	*Isocoma menziesii, Salix lasiolepis* - dead		
44.5	LL	*Baccharis pilularis, Salix lasiolepis* - dead		
45	LL			
45.5	LL	*Salix lasiolepis*		
46	*Bolboschoenus maritimus* ssp. *paludosus*	*Baccharis pilularis, Salix lasiolepis*	*Salix lasiolepis*	
46.5	*Polypogon monspeliensis**		*Salix lasiolepis*	
47	*Polypogon monspeliensis**		*Salix lasiolepis*	
47.5	*Polypogon monspeliensis**		*Salix lasiolepis*	
48	*Polypogon monspeliensis**		*Salix lasiolepis*	
48.5	*Polypogon monspeliensis**		*Salix lasiolepis*	
49	*Polypogon monspeliensis**		*Salix lasiolepis*	
49.5	LL		*Salix lasiolepis*	
50	LL		*Salix lasiolepis*	

Appendix E (cont.)
TRANSECT DATA – CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT
YEAR 4 MONITORING REPORT

TRANSECT 2 (SWS)				
m	**Species Layer**			**Belt Transect Species**
	Herb	**Shrub**	**Tree**	
0.5	LL			Native (15)
1	LL	*Salix exigua*		*Ambrosia psilostachya*
1.5	*Oenothera elata*	*Salix exigua*		*Baccharis salicifolia*
2	BG			*Bolboschoenus maritimus* ssp. *paludosus*
2.5	*Salix exigua*			*Deinandra fasciculata*
3	*Oenothera elata*	*Salix exigua*		*Epilobium ciliatum* ssp. *ciliatum*
3.5	BG	*Salix exigua*		*Gnaphalium californicum*
4	BG			*Isocoma menziesii*
4.5	BG	*Salix exigua, Salix lasiolepis*		*Juncus acutus*
5	BG	*Salix exigua*		*Oenothera elata*
5.5	*Salix exigua*			*Pluchea odorata*
6	LL	*Salix exigua*	*Baccharis salicifolia*	*Populus fremontii*
6.5	*Juncus acutus, Salix exigua*	*Baccharis salicifolia*	*Baccharis salicifolia*	*Salix exigua*
7	LL			*Salix lasiolepis*
7.5	BG			*Symphyotrichum* [*Aster*] *subulatum*
8	LL	*Salix exigua*		*Typha* sp.
8.5	BG			
9	BG			Non-native (7)
9.5	BG			*Anagallis arvensis*
10	*Oenothera elata*			*Apium graveolens*
10.5	*Oenothera elata*			*Cotula coronopifolia*
11	*Pluchea odorata*			*Polypogon monspeliensis*
11.5	*Oenothera elata*			*Sonchus asper*
12	LL			*Spergularia* sp.
12.5	*Oenothera elata*	*Salix exigua*		*Tamarix* sp.
13	*Oenothera elata*	*Salix exigua*		
13.5	*Oenothera elata*	*Salix exigua*		
14	*Oenothera elata*			
14.5	LL			
15	*Pluchea odorata*	*Salix exigua*		
15.5	*Ambrosia psilostachya*	*Salix exigua*		
16	*Bolboschoenus maritimus* ssp. *paludosus*	*Populus fremontii, Salix exigua*		
16.5	*Juncus acutus*	*Salix exigua*		
17	*Pluchea odorata*	*Salix exigua*		
17.5	LL	*Juncus acutus, Salix exigua, Typha* sp.		
18	*Pluchea odorata*	*Salix exigua, Typha* sp.		
18.5	*Juncus acutus, Pluchea odorata*	*Salix exigua*		
19	*Juncus acutus, Pluchea odorata, Salix exigua*	*Juncus acutus*		
19.5	LL	*Juncus acutus, Pluchea odorata, Typha* sp.		
20	LL	*Juncus acutus, Typha* sp.		
20.5	LL	*Salix exigua, Typha* sp.		
21	*Pluchea odorata*	*Typha* sp.		
21.5	*Pluchea odorata*			

Herb Layer:
Natives: 54%
Non-natives: 2%
Shrub Layer
Natives: 62%
Non-natives: 0%
Tree Layer
Natives: 7%
Non-natives: 0%

Total Native Cover: 83%

Native Richness: 15

Appendix E (cont.)
TRANSECT DATA – CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT
YEAR 4 MONITORING REPORT

TRANSECT 2 (cont.)				
m	**Species Layer**			**Belt Transect Species**
	Herb	**Shrub**	**Tree**	
22	BG			
22.5	BG			
23	BG			
23.5	BG	*Salix lasiolepis*		
24	*Juncus acutus, Pluchea odorata*	*Salix exigua, Salix lasiolepis*		
24.5	LL	*Salix lasiolepis*		
25	*Oenothera elata*	*Salix exigua*		
25.5	*Pluchea odorata*	*Salix exigua*		
26	*Pluchea odorata*	*Salix exigua*		
26.5	BG			
27	*Typha* sp. - dead	*Salix exigua*		
27.5	*Typha* sp. - dead			
28	BG			
28.5	*Salix exigua*	*Salix exigua*		
29	LL	*Salix exigua*		
29.5	*Oenothera elata, Salix exigua*			
30	*Salix exigua*	*Baccharis salicifolia, Salix exigua*		
30.5	*Oenothera elata, Salix exigua*	*Salix exigua*		
31	*Oenothera elata, Salix exigua*			
31.5	*Salix exigua*			
32	*Spergularia* sp.*	*Salix exigua*		
32.5	*Juncus acutus*	*Salix exigua*		
33	*Pluchea odorata*	*Salix exigua*		
33.5	BG	*Salix exigua*		
34	LL	*Pluchea odorata, Salix exigua*		
34.5	*Salix exigua*			
35	*Ambrosia psilostachya*			
35.5	*Salix exigua*			
36	*Oenothera elata*	*Salix exigua*		
36.5	LL	*Salix exigua*		
37	*Juncus acutus*	*Salix exigua*		
37.5	*Spergularia* sp.*	*Salix exigua*		
38	LL	*Salix exigua*		
38.5	*Oenothera elata*	*Salix exigua*		
39	*Isocoma menziesii, Pluchea odorata*	*Salix exigua*		
39.5	*Pluchea odorata, Salix exigua*	*Salix exigua*		
40	*Pluchea odorata*	*Salix exigua*		
40.5	*Juncus acutus, Pluchea odorata, Salix exigua*			
41	*Oenothera elata*	*Salix exigua*		
41.5	*Oenothera elata*	*Salix exigua*		
42	*Oenothera elata, Salix exigua*	*Salix exigua*		

Appendix E (cont.)
TRANSECT DATA – CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT
YEAR 4 MONITORING REPORT

TRANSECT 2 (cont.)				
m	**Species Layer**			**Belt Transect Species**
	Herb	**Shrub**	**Tree**	
42.5	*Oenothera elata*	*Salix exigua*		
43	*Oenothera elata*	*Salix exigua*		
43.5	*Oenothera elata, Pluchea odorata*	*Salix exigua*		
44	*Oenothera elata*	*Salix exigua*		
44.5	*Oenothera elata*	*Salix exigua, Salix lasiolepis*		
45	LL	*Salix exigua*		
45.5	LL	*Salix exigua*		
46	LL	*Salix exigua*		
46.5	LL			
47	LL	*Salix lasiolepis*		
47.5	*Salix exigua*			
48	LL		*Salix lasiolepis*	
48.5	LL		*Salix lasiolepis*	
49	LL		*Salix lasiolepis*	
49.5	LL		*Salix lasiolepis*	
50	LL		*Salix lasiolepis*	

Appendix E (cont.)
TRANSECT DATA – CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT
YEAR 4 MONITORING REPORT

TRANSECT 3 (SWS)				
m	**Species Layer**			**Belt Transect Species**
	Herb	**Shrub**	**Tree**	
0.5	*Polypogon monspeliensis**	Nassella sp., *Encelia californica* - dead		Native (18)
1	BG	*Encelia californica* - dead		*Artemisia californica*
1.5	BG			*Baccharis salicifolia*
2	BG	*Baccharis salicifolia*		*Bolboschoenus maritimus* ssp. *paludosus*
2.5	*Juncus acutus*	*Baccharis salicifolia*		*Distichlis spicata*
3	*Juncus acutus*	*Bolboschoenus maritimus* ssp. *paludosus, Polypogon monspeliensis**		*Encelia californica*
3.5	LL	*Bolboschoenus maritimus* ssp. *paludosus, Polypogon monspeliensis**		*Eriogonum fasciculatum*
4	LL	*Bolboschoenus maritimus* ssp. *paludosus, Polypogon monspeliensis**		*Heterotheca grandiflora*
4.5	LL	*Bolboschoenus maritimus* ssp. *paludosus, Polypogon monspeliensis**		*Juncus acutus*
5	LL	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp., *Polypogon monspeliensis**		*Lotus scoparius*
5.5	LL	*Bolboschoenus maritimus* ssp. *paludosus, Pluchea odorata, Typha* sp., *Polypogon monspeliensis**		*Malosma laurina*
6	*Bolboschoenus maritimus* ssp. *paludosus*	*Polypogon monspeliensis**		*Nassella lepida*
6.5	*Polypogon monspeliensis**	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp., *Polypogon monspeliensis**		*Nassella* sp.
7	*Distichlis spicata*	*Bolboschoenus maritimus* ssp. *paludosus, Pluchea odorata*		*Pluchea odorata*
7.5	*Distichlis spicata*	*Bolboschoenus maritimus ssp. paludosus, Typha* sp.		*Salix exigua*
8	*Polypogon monspeliensis**	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp., *Polypogon monspeliensis**		*Salix lasiolepis*
8.5	*Distichlis spicata*	*Bolboschoenus maritimus* ssp. *paludosus, Polypogon monspeliensis**		*Salvia mellifera*
9	LL	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp., *Polypogon monspeliensis**		*Schoenoplectus acutus* var. *occidentalis*
9.5	LL	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp., *Polypogon monspeliensis**		*Typha* sp.
10	LL	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp., *Polypogon monspeliensis**		
10.5	LL	*Bolboschoenus maritimus* ssp. *paludosus, Polypogon monspeliensis**		Non-native (1)

Herb Layer:
Natives: 30%
Non-natives: 13%
Shrub Layer
Natives: 77%
Non-natives: 27%
Tree Layer
Natives: 8%
Non-natives: 0%
Total Native Cover: 87%
Native Richness: 18

Appendix E (cont.)
TRANSECT DATA – CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT
YEAR 4 MONITORING REPORT

TRANSECT 3 (SWS) (cont.)				
m	**Species Layer**			**Belt Transect Species**
	Herb	**Shrub**	**Tree**	
11	LL	*Bolboschoenus maritimus* ssp. *paludosus, Polypogon monspeliensis**		*Polypogon monspeliensis*
11.5	LL	*Bolboschoenus maritimus* ssp. *paludosus, Distichlis spicata, Polypogon monspeliensis**		
12	LL	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp., *Polypogon monspeliensis**		
12.5	LL	*Bolboschoenus maritimus* ssp. *paludosus, Distichlis spicata, Typha* sp., *Polypogon monspeliensis**		
13	LL	*Bolboschoenus maritimus* ssp. *paludosus, Distichlis spicata, Pluchea odorata, Typha* sp., *Polypogon monspeliensis**		
13.5	LL	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp., *Polypogon monspeliensis**		
14	*Polypogon monspeliensis**	*Bolboschoenus maritimus* ssp. *paludosus, Polypogon monspeliensis**		
14.5	*Polypogon monspeliensis**	*Bolboschoenus maritimus* ssp. *paludosus, Polypogon monspeliensis**		
15	*Bolboschoenus maritimus* ssp. *paludosus, Polypogon monspeliensis**	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
15.5	*Bolboschoenus maritimus* ssp. *paludosus*	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp., *Polypogon monspeliensis**		
16	LL	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
16.5	*Distichlis spicata*	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
17	*Distichlis spicata*	*Typha* sp.		
17.5	*Distichlis spicata*	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
18	*Polypogon monspeliensis**	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
18.5	LL	*Bolboschoenus maritimus* ssp. *paludosus, Pluchea odorata, Typha* sp.		
19	*Bolboschoenus maritimus* ssp. *paludosus, Polypogon monspeliensis**	*Typha* sp., *Polypogon monspeliensis**		
19.5	*Distichlis spicata, Polypogon monspeliensis**	*Typha* sp.		

Appendix E (cont.)
TRANSECT DATA – CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT
YEAR 4 MONITORING REPORT

TRANSECT 3 (SWS) (cont.)				
m	**Species Layer**			**Belt Transect Species**
	Herb	**Shrub**	**Tree**	
20	*Polypogon monspeliensis**	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp., *Polypogon monspeliensis**		
20.5	LL	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp., *Polypogon monspeliensis**		
21	*Polypogon monspeliensis**	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp., *Polypogon monspeliensis**		
21.5	*Polypogon monspeliensis**	*Typha* sp.		
22	LL	*Typha* sp.		
22.5	LL	*Bolboschoenus maritimus* ssp. *paludosus*, *Distichlis spicata*, *Typha* sp.		
23	*Distichlis spicata*	*Bolboschoenus maritimus* ssp. *paludosus*, *Distichlis spicata*, *Typha* sp.		
23.5	*Distichlis spicata*	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
24	LL	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
24.5	LL	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
25	LL	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
25.5	LL	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
26	LL	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
26.5	LL	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
27	BG	*Typha* sp.		
27.5	LL	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
28	LL	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
28.5	LL	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
29	LL	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
29.5	LL	*Typha* sp.		
30	*Bolboschoenus maritimus* ssp. *paludosus*	*Typha* sp.		
30.5	LL	*Typha* sp.		
31	LL	*Typha* sp.		
31.5	LL	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
32	LL	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
32.5	LL	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
33	*Distichlis spicata*	*Bolboschoenus maritimus* ssp. *paludosus*		

Appendix E (cont.)
TRANSECT DATA – CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT
YEAR 4 MONITORING REPORT

TRANSECT 3 (cont.)				
m	**Species Layer**			**Belt Transect Species**
	Herb	**Shrub**	**Tree**	
33.5	BG	*Bolboschoenus maritimus* ssp. *paludosus*		
34	*Distichlis spicata*	*Bolboschoenus maritimus* ssp. *paludosus*		
34.5	*Distichlis spicata*	*Bolboschoenus maritimus* ssp. *paludosus*		
35	*Distichlis spicata*	*Juncus acutus*		
35.5	*Bolboschoenus maritimus* ssp. *paludosus*	*Juncus acutus*		
36	*Distichlis spicata*	*Bolboschoenus maritimus* ssp. *paludosus*		
36.5	*Distichlis spicata*	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
37	*Distichlis spicata, Juncus acutus*	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
37.5	*Bolboschoenus maritimus* ssp. *paludosus, Distichlis spicata*	*Typha* sp.		
38	BG			
38.5	BG	*Typha* sp.		
39	BG	*Typha* sp.		
39.5	BG	*Typha* sp.		
40	*Juncus acutus*		*Salix exigua*	
40.5	BG	*Typha* sp.	*Salix exigua*	
41	*Bolboschoenus maritimus* ssp. *paludosus*		*Salix exigua*	
41.5	BG		*Salix exigua*	
42	*Bolboschoenus maritimus* ssp. *paludosus*		*Salix exigua*	
42.5	BG	*Salix exigua*		
43	BG		*Salix exigua*	
43.5	*Juncus acutus*			
44	BG		*Salix exigua*	
44.5	BG		*Salix exigua*	
45	BG			
45.5	BG			
46	BG			
46.5	BG			
47	*Juncus acutus*			
47.5	LL			
48	BG			
48.5	*Polypogon monspeliensis**			
49	BG			
49.5	BG			
50	BG			

Appendix E (cont.)
TRANSECT DATA – CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT
YEAR 4 MONITORING REPORT

TRANSECT 4 (STREAMBED)				
m	**Species Layer**			**Belt Transect Species**
	Herb	**Shrub**	**Tree**	
0.5	BG			Native (6)
1	BG			*Baccharis salicifolia*
1.5	*Spergularia* sp.*	*Typha* sp.		*Bolboschoenus maritimus* ssp. *paludosus*
2	BG	*Typha* sp.		*Pluchea odorata*
2.5	BG	*Typha* sp.		*Salicornia* sp.
3	BG	*Typha* sp.		*Salix lasiolepis*
3.5	*Pluchea odorata*	*Typha* sp.		*Typha* sp.
4	BG	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
4.5	BG	*Pluchea odorata, Typha* sp.		Non-native (5)
5	BG	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		*Cortaderia selloana*
5.5	BG	*Typha* sp.		*Cotula coronopifolia*
6	BG	*Pluchea odorata, Typha* sp.		*Polypogon monspeliensis*
6.5	BG	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		*Spergularia* sp.
7	BG	*Pluchea odorata* - dead, *Typha* sp.		*Tamarix* sp.
7.5	LL	*Typha* sp.		
8	*Pluchea odorata*	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
8.5	BG	*Typha* sp.		
9	BG	*Typha* sp.		
9.5	BG	*Typha* sp.		
10	BG	*Typha* sp.		
10.5	BG	*Typha* sp.		
11	BG	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
11.5	BG	*Typha* sp.		
12	BG	*Typha* sp.		
12.5	BG	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
13	BG	*Typha* sp.	*Salix lasiolepis*	
13.5	BG	*Typha* sp.	*Salix lasiolepis*	
14	BG	*Typha* sp.	*Salix lasiolepis*	
14.5	BG	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.	*Salix lasiolepis*	
15	BG	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.	*Salix lasiolepis*	
15.5	BG	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
16	BG	*Bolboschoenus maritimus* ssp. *paludosus, Pluchea odorata, Typha* sp.		
16.5	BG	*Pluchea odorata, Typha* sp.		
17	BG	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
17.5	BG	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
18	BG	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		

Herb Layer:
Natives: 12%
Non-natives: 6%
Shrub Layer
Natives: 88%
Non-natives: 0%
Tree Layer
Natives: 5%
Non-natives: 0%

Total Native Cover: 91%
Native Richness: 6

Appendix E (cont.)
TRANSECT DATA – CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT
YEAR 4 MONITORING REPORT

TRANSECT 4 (STREAMBED) (cont.)				
m	**Species Layer**			**Belt Transect Species**
	Herb	**Shrub**	**Tree**	
18.5	BG	*Typha* sp.		
19	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
19.5	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
20	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
20.5	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
21	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
21.5	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
22	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
22.5	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
23	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
23.5	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
24	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
24.5	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
25	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
25.5	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
26	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
26.5	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
27	BG	*Typha* sp.		
27.5	BG	*Typha* sp.		
28	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
28.5	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Typha* sp.		
29	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Pluchea odorata*, *Typha* sp.		
29.5	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Pluchea odorata*, *Typha* sp.		
30	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Pluchea odorata*, *Typha* sp.		
30.5	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Pluchea odorata*, *Typha* sp.		
31	BG	*Bolboschoenus maritimus* ssp. *paludosus*, *Pluchea odorata*, *Typha* sp.		

Appendix E (cont.)
TRANSECT DATA – CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT
YEAR 4 MONITORING REPORT

TRANSECT 4 (STREAMBED) (cont.)				
m	**Species Layer**			**Belt Transect Species**
	Herb	**Shrub**	**Tree**	
31.5	BG	*Bolboschoenus maritimus* ssp. *paludosus, Pluchea odorata, Typha* sp.		
32	BG	*Bolboschoenus maritimus* ssp. *paludosus, Pluchea odorata, Typha* sp.		
32.5	BG	*Typha* sp.		
33	BG	*Typha* sp.		
33.5	BG	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
34	BG	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
34.5	BG	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
35	BG	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
35.5	BG	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
36	BG	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
36.5	BG	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
37	BG	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
37.5	BG	*Typha* sp.		
38	BG	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
38.5	BG	*Typha* sp.		
39	BG	*Typha* sp.		
39.5	BG	*Bolboschoenus maritimus* ssp. *paludosus, Pluchea odorata, Typha* sp.		
40	BG	*Pluchea odorata, Typha* sp.		
40.5	BG	*Bolboschoenus maritimus* ssp. *paludosus, Pluchea odorata, Typha* sp.		
41	BG	*Pluchea odorata, Typha* sp.		
41.5	BG	*Bolboschoenus maritimus* ssp. *paludosus, Pluchea odorata, Typha* sp.		
42	*Bolboschoenus maritimus* ssp. *paludosus*	*Pluchea odorata, Typha* sp.		
42.5	*Pluchea odorata*	*Typha* sp.		
43	*Pluchea odorata*	*Bolboschoenus maritimus* ssp. *paludosus, Pluchea odorata, Typha* sp.		
43.5	*Bolboschoenus maritimus* ssp. *paludosus, Pluchea odorata*	*Typha* sp.		
44	*Pluchea odorata*	*Bolboschoenus maritimus* ssp. *paludosus, Typha* sp.		
44.5	*Pluchea odorata*	*Typha* sp.		

Appendix E (cont.)
TRANSECT DATA – CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT
YEAR 4 MONITORING REPORT

TRANSECT 4 (STREAMBED) (cont.)				
m	**Species Layer**			**Belt Transect Species**
	Herb	**Shrub**	**Tree**	
45	*Bolboschoenus maritimus* ssp. *paludosus*	*Typha* sp.		
45.5	*Spergularia* sp.*			
46	*Polypogon monspeliensis**			
46.5	BG			
47	BG			
47.5	*Typha* sp., *Polypogon monspeliensis**			
48	*Bolboschoenus maritimus* ssp. *paludosus*			
48.5	*Pluchea odorata*			
49	LL			
49.5	*Polypogon monspeliensis**, *Spergularia* sp.*			
50	*Polypogon monspeliensis**			

Appendix E (cont.)
TRANSECT DATA – CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT
YEAR 4 MONITORING REPORT

TRANSECT 5 (MFS)				
m	**Species Layer**			**Belt Transect Species**
	Herb	**Shrub**	**Tree**	
0.5	LL			Native (10)
1	*Baccharis pilularis*	*Baccharis salicifolia*		*Ambrosia psilostachya*
1.5	*Deinandra fasciculata*	*Baccharis salicifolia*		*Artemisia californica*
2	*Heterotheca grandiflora, Lotus scoparius*	*Baccharis salicifolia*		*Baccharis pilularis*
2.5	BG	*Baccharis salicifolia*		*Baccharis salicifolia*
3	*Baccharis pilularis*	*Baccharis salicifolia*		*Deinandra fasciculata*
3.5	LL	*Baccharis salicifolia*		*Heterotheca grandiflora*
4	LL	*Baccharis pilularis*		*Iva hayesiana*
4.5	*Heterotheca grandiflora*	*Baccharis pilularis*		*Lotus scoparius*
5	*Baccharis pilularis*	*Baccharis salicifolia*		*Pluchea odorata*
5.5	LL	*Baccharis salicifolia*		*Salvia mellifera*
6	*Baccharis pilularis*	*Baccharis salicifolia*		
6.5	*Baccharis pilularis*	*Baccharis salicifolia*		Non-native (5)
7	LL	*Baccharis salicifolia*		*Anagallis arvensis*
7.5	*Baccharis pilularis, Anagallis arvensis**	*Baccharis salicifolia* - dead		*Brachypodium distachyon*
8	LL	*Baccharis salicifolia* - dead		*Bromus madritensis*
8.5	*Baccharis pilularis*			*Dittrichia graveolens*
9	LL	*Baccharis salicifolia*		*Polypogon monspeliensis*
9.5	LL	*Baccharis salicifolia*		
10	LL	*Baccharis salicifolia*		
10.5	BG			
11	BG			
11.5	BG			
12	*Polypogon monspeliensis**	*Baccharis salicifolia*		
12.5	LL			
13	LL	*Baccharis salicifolia*		
13.5	*Polypogon monspeliensis**	*Baccharis salicifolia*		
14	*Polypogon monspeliensis**	*Baccharis salicifolia*		
14.5	BG			
15	LL	*Baccharis salicifolia*		
15.5	LL	*Baccharis salicifolia*		
16	LL	*Baccharis salicifolia*		
16.5	LL	*Baccharis salicifolia*		
17	LL	*Baccharis salicifolia*		
17.5	LL	*Baccharis salicifolia*		
18	LL	*Baccharis salicifolia*		
18.5	LL			
19	LL			
19.5	LL	*Baccharis salicifolia*		
20	*Polypogon monspeliensis**	*Baccharis salicifolia*		
20.5	LL	*Baccharis salicifolia*		
21	LL			
21.5	LL			

Herb Layer:
Natives: 20%
Non-natives: 12%

Shrub Layer
Natives: 64%
Non-natives: 0%

Tree Layer
Natives: 0%
Non-natives: 0%

Total Native Cover: 68%
Native Richness: 10

Appendix E (cont.)
TRANSECT DATA – CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT
YEAR 4 MONITORING REPORT

TRANSECT 5 (MFS) (cont.)				
m	**Species Layer**			**Belt Transect Species**
	Herb	**Shrub**	**Tree**	
22	LL			
22.5	LL			
23	LL	*Baccharis salicifolia*		
23.5	LL	*Baccharis salicifolia*		
24	BG			
24.5	*Polypogon monspeliensis**			
25	LL			

Appendix E (cont.)
TRANSECT DATA – CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT
YEAR 4 MONITORING REPORT

TRANSECT 6 (SWS Reference)				
m	**Species Layer**			**Belt Transect Species**
	Herb	**Shrub**	**Tree**	
0.5	BG	*Baccharis pilularis* - dead	*Quercus agrifolia*	Native (11)
1	LL	*Baccharis pilularis* - dead	*Quercus agrifolia*	*Ambrosia psilostachya*
1.5	LL	*Baccharis pilularis* - dead		*Artemisia douglasiana*
2	BG		*Salix lasiolepis*	*Baccharis pilularis*
2.5	LL		*Salix lasiolepis*	*Baccharis salicifolia*
3	BG		*Salix lasiolepis*	*Baccharis salicifolia*
3.5	BG		*Salix lasiolepis*	*Leymus condensatus*
4	BG		*Salix lasiolepis*	*Pluchea odorata*
4.5	BG		*Salix lasiolepis*	*Quercus agrifolia*
5	BG	*Typha* sp.	*Salix lasiolepis*	*Rorippa nasturtium-aquaticum*
5.5	BG		*Salix lasiolepis*	*Salix lasiolepis*
6	OW		*Salix lasiolepis*	*Typha* sp.
6.5	OW		*Salix lasiolepis*	
7	*Rorippa nasturtium-aquaticum*		*Salix lasiolepis*	Non-native (1)
7.5	*Rorippa nasturtium-aquaticum*		*Salix lasiolepis*	*Apium graveolens*
8	*Rorippa nasturtium-aquaticum*		*Salix lasiolepis*	
8.5	*Rorippa nasturtium-aquaticum*		*Salix lasiolepis*	
9	*Rorippa nasturtium-aquaticum*		*Salix lasiolepis*	
9.5	*Rorippa nasturtium-aquaticum*		*Salix lasiolepis*	
10	*Rorippa nasturtium-aquaticum*		*Salix lasiolepis*	
10.5	BG		*Salix lasiolepis*	

Herb Layer:

Natives: 16%

Non-natives: 2%

Shrub Layer

Natives: 22%

Non-natives: 0%

Tree Layer

Natives: 84%

Non-natives: 0%

Total Native Cover: 98%

Native Richness: 10

Appendix E (cont.)
TRANSECT DATA – CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT
YEAR 4 MONITORING REPORT

TRANSECT 6 (SWS Reference) (cont.)				
m	**Species Layer**			**Belt Transect Species**
	Herb	**Shrub**	**Tree**	
11	*Rorippa nasturtium-aquaticum*		*Salix lasiolepis*	
11.5	BG		*Salix lasiolepis*	
12	BG		*Salix lasiolepis*	
12.5	BG		*Salix lasiolepis*	
13	LL		*Salix lasiolepis*	
13.5	LL		*Salix lasiolepis*	
14	LL		*Salix lasiolepis*	
14.5	LL		*Salix lasiolepis*	
15	LL		*Salix lasiolepis*	
15.5	LL		*Salix lasiolepis*	
16	LL		*Salix lasiolepis*	
16.5	LL		*Salix lasiolepis*	
17	LL		*Salix lasiolepis*	
17.5	LL		*Salix lasiolepis*	
18	BG		*Salix lasiolepis*	
18.5	LL		*Baccharis salicifolia, Salix lasiolepis*	
19	LL		*Baccharis salicifolia, Salix lasiolepis*	
19.5	LL		*Baccharis salicifolia, Salix lasiolepis*	
20	LL	*Baccharis salicifolia* - dead	*Salix lasiolepis*	
20.5	LL	*Baccharis salicifolia*	*Salix lasiolepis*	
21	BG	*Baccharis salicifolia*		
21.5	*Apium graveolens**	*Baccharis salicifolia, Salix lasiolepis*		

Appendix E (cont.)
TRANSECT DATA – CARLSBAD RACEWAY RIPARIAN RESTORATION PROJECT
YEAR 4 MONITORING REPORT

TRANSECT 6 (SWS Reference) (cont.)				
m	**Species Layer**			**Belt Transect Species**
	Herb	**Shrub**	**Tree**	
22	BG	*Baccharis salicifolia*		
22.5	LL	*Baccharis salicifolia*		
23	LL	*Artemisia douglasiana, Baccharis salicifolia, Leymus condensatus*		
23.5	LL	*Artemisia douglasiana, Baccharis salicifolia, Leymus condensatus*		
24	LL	*Artemisia douglasiana, Baccharis salicifolia, Leymus condensatus*		
24.5	LL	*Artemisia douglasiana, Leymus condensatus*	*Baccharis salicifolia*	
25	LL	*Artemisia douglasiana, Leymus condensatus*	*Salix lasiolepis*	

*Non-native species

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